User Security Configuration Guide, Cisco IOS Release 12.2SX

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

CONTENTS

Cisco IOS Login Enhancements-Login Block

The Cisco IOS Login Enhancements (Login Block) feature allows users to enhance the security of a router by configuring options to automatically block further login attempts when a possible denial-of-service (DoS) attack is detected.

The login block and login delay options introduced by this feature can be configured for Telnet or SSH virtual connections. By enabling this feature, you can slow down “dictionary attacks” by enforcing a “quiet period” if multiple failed connection attempts are detected, thereby protecting the routing device from a type of denial-of-service attack.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Cisco IOS Login Enhancements

Protecting Against Denial of Service and Dictionary Login Attacks

Connecting to a routing device for the purposes of administering (managing) the device, at either the User or Executive level, is most frequently performed using Telnet or SSH (secure shell) from a remote console (such as a PC). SSH provides a more secure connection option because communication traffic between the user’s device and the managed device are encrypted. The Login Block capability, when enabled, applies to both Telnet connections and SSH connections. Beginning in Release versions 12.3(33)SRB2, 12.2(33)SXH2, and 12.4(15)T1, the Login Block capability also applies to HTTP connections.”

The automated activation and logging of the Login Block and Quiet Period capabilities introduced by this feature are designed to further enhance the security of your devices by specifically addressing two well known methods that individuals use to attempt to disrupt or compromise network devices.

If the connection address of a device is discovered and is reachable, a malicious user may attempt to interfere with the normal operations of the device by flooding it with connection requests. This type of attack is referred to as an attempted Denial-of-Service, because it is possible that the device may become too busy trying to process the repeated login connection attempts to properly handle normal routing services or are not able to provide the normal login service to legitimate system administrators.

The primary intention of a dictionary attack, unlike a typical DoS attack, is to actually gain administrative access to the device. A dictionary attack is an automated process to attempt to login by attempting thousands, or even millions, of username/password combinations. (This type of attack is called a “dictionary attack” because it typically uses, as a start, every word found in a typical dictionary as a possible password.) As scripts or programs are used to attempt this access, the profile for such attempts is typically the same as for DoS attempts; multiple login attempts in a short period of time.

By enabling a detection profile, the routing device can be configured to react to repeated failed login attempts by refusing further connection request (login blocking). This block can be configured for a period of time, called a “quiet period”. Legitimate connection attempts can still be permitted during a quiet period by configuring an access-list (ACL) with the addresses that you know to be associated with system administrators.

Login Enhancements Functionality Overview

Delays Between Successive Login Attempts

A Cisco IOS device can accept virtual connections as fast as they can be processed. Introducing a delay between login attempts helps to protect the Cisco IOS software-based device against malicious login connections such as dictionary attacks and DoS attacks. Delays can be enabled in one of the following ways:

- Through the **auto secure** command. If you enable the AutoSecure feature, the default login delay time of one second is automatically enforced.
- Through the **login block-for** command. You must enter this command before issuing the **login delay** command. If you enter only the **login block-for** command, the default login delay time of one second is automatically enforced.
- Through the new global configuration mode command, **login delay**, which allows you to specify login delay time to be enforced, in seconds.

Login Shutdown If DoS Attacks Are Suspected

If the configured number of connection attempts fail within a specified time period, the Cisco IOS device does not accept any additional connections for a “quiet period.” (Hosts that are permitted by a predefined access-control list [ACL] are excluded from the quiet period.)

The number of failed connection attempts that trigger the quiet period can be specified through the new global configuration mode command **login block-for**. The predefined ACL that is excluded from the quiet period can be specified through the new global configuration mode command **login quiet-mode access-class**.

This functionality is disabled by default, and it is not enabled if AutoSecure if enabled.

How to Configure Cisco IOS Login Enhancements

Configuring Login Parameters

Use this task to configure your Cisco IOS device for login parameters that help detect suspected DoS attacks and slow down dictionary attacks.

All login parameters are disabled by default. You must issue the **login block-for** command, which enables default login functionality, before using any other login commands. After the **login block-for** command is enabled, the following defaults are enforced:

- A default login delay of one second
- All login attempts made through Telnet or SSH are denied during the quiet period; that is, no ACLs are exempt from the login period until the **login quiet-mode access-class** command is issued.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **login block-for** *seconds* **attempts** *tries* **within** *seconds*
4. **login quiet-mode access-class** {*acl-name* | *acl-number*}
5. **login delay** *seconds*
6. **exit**
7. **show login failures**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**login block-for** *seconds* **attempts** *tries* **within** *seconds* **Example:** `Router(config)# login block-for 100 attempts 2 within 100`	Configures your Cisco IOS device for login parameters that help provide DoS detection. **Note** This command must be issued before any other login command can be used.

Step 4	**login quiet-mode access-class** {*acl-name* | *acl-number*}
	Example:
	`Router(config)# login quiet-mode access-class myacl`
		(Optional) Although this command is optional, it is recommended that it be configured to specify an ACL that is to be applied to the router when the router switches to quiet mode. When the router is in quiet mode, all login requests are denied and the only available connection is through the console.
		If this command is not configured, then the default ACL **sl_def_acl** is created on the router. This ACL is hidden in the running configuration. Use the **show access-list sl_def_acl** to view the parameters for the default ACL.
		For example:
		`Router#show access-lists sl_def_acl`
		`Extended IP access list sl_def_acl`
		`    10 deny tcp any any eq telnet`
		`    20 deny tcp any any eq www`
		`    30 deny tcp any any eq 22`
		`    40 permit ip any any`

Step 5	**login delay** *seconds* **Example:** `Router(config)# login delay 10`	(Optional) Configures a delay between successive login attempts.
Step 6	**exit** **Example:** `Router# exit`	Exits to privileged EXEC mode.

	Command or Action	Purpose
Step 7	**show login failures** **Example:** `Router# show login`	Displays login parameters. - **failures** --Displays information related only to failed login attempts.

Configuration Examples for Login Parameters

Setting Login Parameters Example

The following example shows how to configure your router to enter a 100 second quiet period if 15 failed login attempts is exceeded within 100 seconds; all login requests are denied during the quiet period except hosts from the ACL “myacl.”

```
Router(config)# login block-for 100 attempts 15 within 100
Router(config)# login quiet-mode access-class myacl
```

Showing login Parameters Example

The following sample output from the **show login** command verifies that no login parameters have been specified:

```
Router# show login
No login delay has been applied.
No Quiet-Mode access list has been configured.
All successful login is logged and generate SNMP traps.
All failed login is logged and generate SNMP traps
Router NOT enabled to watch for login Attacks
```

The following sample output from the **show login** command verifies that the **login block-for**command is issued. In this example, the command is configured to block login hosts for 100 seconds if 16 or more login requests fail within 100 seconds; five login requests have already failed.

```
Router# show login
A default login delay of 1 seconds is applied.
No Quiet-Mode access list has been configured.
All successful login is logged and generate SNMP traps.
All failed login is logged and generate SNMP traps.
Router enabled to watch for login Attacks.
If more than 15 login failures occur in 100 seconds or less, logins will be disabled for
100 seconds.
Router presently in Watch-Mode, will remain in Watch-Mode for 95 seconds.
Present login failure count 5.
```

The following sample output from the **show login** command verifies that the router is in quiet mode. In this example, the **login block-for** command was configured to block login hosts for 100 seconds if 3 or more login requests fail within 100 seconds.

```
Router# show login
```

```
A default login delay of 1 seconds is applied.
No Quiet-Mode access list has been configured.
All successful login is logged and generate SNMP traps.
All failed login is logged and generate SNMP traps.
Router enabled to watch for login Attacks.
If more than 2 login failures occur in 100 seconds or less, logins will be disabled for
100 seconds.
Router presently in Quiet-Mode, will remain in Quiet-Mode for 93 seconds.
Denying logins from all sources.
```

The following sample output from **show login failures** command shows all failed login attempts on the router:

```
Router# show login failures
Information about login failure's with the device
Username      Source IPAddr   lPort Count  TimeStamp
try1          10.1.1.1        23    1      21:52:49 UTC Sun Mar 9 2003
try2          10.1.1.2        23    1      21:52:52 UTC Sun Mar 9 2003
```

The following sample output from **show login failures** command verifies that no information is presently logged:

```
Router# show login failures
*** No logged failed login attempts with the device.***
```

Additional References

Related Documents

Related Topic	Document Title
AutoSecure	AutoSecure feature module.
Secure Management/Administrative Access	Role-Based CLI Access feature module.

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Cisco IOS Login Enhancements-Login Block

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 Feature Information for Cisco IOS Login Enhancements (Login Block)

Feature Name	Releases	Feature Information
Cisco IOS Login Enhancements (Login Block)	12.3(4)T 12.2(25)S 12.2(33)SRA 12.2(33)SRB 12.2(33)SXH 12.4(15)T1	The Cisco IOS Login Enhancements (Login Block) feature allows users to enhance the security of a router by configuring options to automatically block further login attempts when a possible DoS attack is detected. This feature was introduced in Cisco IOS Release 12.3(4)T. This feature was integrated into Cisco IOS Release 12.2(25)S. This feature was integrated into Cisco IOS Release 12.2(33)SRA. Support for HTTP login blocking was integrated into Cisco IOS Release 12.2(33)SRB, 12.2(33)SXH, 12.4(15)T1.

Cisco IOS Resilient Configuration

The Cisco IOS Resilient Configuration feature enables a router to secure and maintain a working copy of the running image and configuration so that those files can withstand malicious attempts to erase the contents of persistent storage (NVRAM and flash).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for Cisco IOS Resilient Configuration

- This feature is available only on platforms that support a Personal Computer Memory Card International Association (PCMCIA) Advanced Technology Attachment (ATA) disk. There must be enough space on the storage device to accommodate at least one Cisco IOS image (two for upgrades) and a copy of the running configuration. IOS Files System (IFS) support for secure file systems is also needed by the software.
- It may be possible to force removal of secured files using an older version of Cisco IOS software that does not contain file system support for hidden files.
- This feature can be disabled only by using a console connection to the router. With the exception of the upgrade scenario, feature activation does not require console access.
- You cannot secure a bootset with an image loaded from the network. The running image must be loaded from persistent storage to be secured as primary.
- Secured files will not appear on the output of a **dir** command issued from an executive shell because the IFS prevents secure files in a directory from being listed. ROM monitor (ROMMON) mode does not have any such restriction and can be used to list and boot secured files. The running image and

running configuration archives will not be visible in the Cisco IOS **dir** command output. Instead, use the **show secure bootset** command to verify archive existence.

Information About Cisco IOS Resilient Configuration

- Feature Design of Cisco IOS Resilient Configuration, page 10

Feature Design of Cisco IOS Resilient Configuration

A great challenge of network operators is the total downtime experienced after a router has been compromised and its operating software and configuration data erased from its persistent storage. The operator must retrieve an archived copy (if any) of the configuration and a working image to restore the router. Recovery must then be performed for each affected router, adding to the total network downtime.

The Cisco IOS Resilient Configuration feature is intended to speed up the recovery process. The feature maintains a secure working copy of the router image and the startup configuration at all times. These secure files cannot be removed by the user. This set of image and router running configuration is referred to as the primary bootset.

The following factors were considered in the design of Cisco IOS Resilient Configuration:

- The configuration file in the primary bootset is a copy of the running configuration that was in the router when the feature was first enabled.
- The feature secures the smallest working set of files to preserve persistent storage space. No extra space is required to secure the primary Cisco IOS image file.
- The feature automatically detects image or configuration version mismatch.
- Only local storage is used for securing files, eliminating scalability maintenance challenges from storing multiple images and configurations on TFTP servers.
- The feature can be disabled only through a console session.

How to Use Cisco IOS Resilient Configuration

- Archiving a Router Configuration, page 10
- Restoring an Archived Router Configuration, page 12

Archiving a Router Configuration

This task describes how to save a primary bootset to a secure archive in persistent storage.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **secure boot-image**
4. **secure boot-config**
5. **end**
6. **show secure bootset**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**secure boot-image** **Example:** `Router(config)# secure boot-image`	Enables Cisco IOS image resilience.
Step 4	**secure boot-config** **Example:** `Router(config)# secure boot-config`	Stores a secure copy of the primary bootset in persistent storage.

Step 5	**end**
	Example:
	`Router(config)# end`
		Exits to privileged EXEC mode.

Step 6	**show secure bootset** **Example:** `Router# show secure bootset`	(Optional) Displays the status of configuration resilience and the primary bootset filename.

Example

The following example displays sample output from the **show secure bootset** command:

```
Router# show secure bootset
IOS resilience router id JMX0704L5GH
IOS image resilience version 12.3 activated at 08:16:51 UTC Sun Jun 16 2002
Secure archive slot0:c3745-js2-mz type is image (elf) []
  file size is 25469248 bytes, run size is 25634900 bytes
  Runnable image, entry point 0x80008000, run from ram
IOS configuration resilience version 12.3 activated at 08:17:02 UTC Sun Jun 16 2002
```

```
Secure archive slot0:.runcfg-20020616-081702.ar type is config
configuration archive size 1059 bytes
```

Restoring an Archived Router Configuration

This task describes how to restore a primary bootset from a secure archive after the router has been tampered with (by an NVRAM erase or a disk format).

Note To restore an archived primary bootset, Cisco IOS image resilience must have been enabled and a primary bootset previously archived in persistent storage.

SUMMARY STEPS

1. **reload**
2. **dir** [*filesystem* **:**]
3. **boot** [*partition-number* **:**][*filename*]
4. **no**
5. **enable**
6. **configure terminal**
7. **secure boot-config** [**restore** *filename*
8. **end**
9. **copy** *filename* **running-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**reload** **Example:** `Router# reload`	(Optional) Enters ROM monitor mode, if necessary.
Step 2	**dir** [*filesystem* **:**] **Example:** `rommon 1 > dir slot0:`	Lists the contents of the device that contains the secure bootset file. • The device name can be found in the output of the **show secure bootset** command.
Step 3	**boot** [*partition-number* **:**][*filename*] **Example:** `rommon 2 > boot slot0:c3745-js2-mz`	Boots up the router using the secure bootset image.

	Command or Action	Purpose

Step 4	**no**
	Example:
	`--- System Configuration Dialog ---`
	Example:
	`Would you like to enter the initial configuration dialog? [yes/no]: no`
		(Optional) Declines to enter an interactive configuration session in setup mode.
		• If the NVRAM was erased, the router enters setup mode and prompts the user to initiate an interactive configuration session.

Step 5	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 6	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 7	**secure boot-config** [**restore** *filename* **Example:** `Router(config)# secure boot-config restore slot0:rescue-cfg`	Restores the secure configuration to the supplied filename.

Step 8	**end**
	Example:
	`Router(config)# end`
		Exits to privileged EXEC mode.

Step 9	**copy** *filename* **running-config** **Example:** `Router# copy slot0:rescue-cfg running-config`	Copies the restored configuration to the running configuration.

Additional References

The following sections provide references related to Cisco IOS Resilient Configuration.

Related Documents

Related Topic	Document Title
Additional commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*The Cisco IOS Configuration Fundamentals and Network Management Command Reference , Release 12.4T*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Cisco IOS Resilient Configuration

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2 Feature Information for Cisco IOS Resilient Configuration

Feature Name	Releases	Feature Information
Cisco IOS Resilient Configuration	12.3(8)T	The Cisco IOS Resilient Configuration feature enables a router to secure and maintain a working copy of the running image and configuration so that those files can withstand malicious attempts to erase the contents of persistent storage (NVRAM and flash). In 12.3(8)T this feature was introduced. The following commands were introduced or modified: **secure boot-config, secure boot-image, show secure bootset.**

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

Image Verification

The Image Verification feature allows users to automatically verify the integrity of Cisco IOS images. Thus, users can be sure that the image is protected from accidental corruption, which can occur at any time during transit, starting from the moment the files are generated by Cisco until they reach the user. The efficiency of Cisco IOS routers is also improved because the routers can now automatically detect when the integrity of an image is accidentally corrupted as a result of transmission errors or disk corruption.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for Image Verification

Cisco IOS Release 12.2(18)S and 12.0(26)S Only

Image Verification is applied to and attempted on any file; however, if the file is not an image file, image verification will not occur and you will see the following error, “SIGNATURE-NOT-FOUND.”

Cisco IOS Release 12.3(4)T Only

Image Verification is applied only to image files. If any other file type is copied or verified, you will not receive a warning that image verification did occur, and the command (copy or verify) will silently succeed.

Note The Image Verification feature can only be used to check the integrity of a Cisco IOS software image that is stored on a Cisco IOS device. It cannot be used to check the integrity of an image on a remote file system or an image running in memory.

Information About Image Verification

How Image Verification Works

Because a production image undergoes a sequence of transfers before it is copied into the memory of a router, the integrity of the image is at risk of accidental corruption every time a transfer occurs. When downloading an image from Cisco.com, a user can run a message-digest5 (MD5) hash on the downloaded image and verify that the MD5 digest posted on Cisco.com is the same as the MD5 digest that is computed on the user's server. However, many users choose not to run an MD5 digest because it is 128-bits long and the verification is manual. Image verification allows the user to automatically validate the integrity of all downloaded images, thereby, significantly reducing user interaction.

How to Use Image Verification

Globally Verifying the Integrity of an Image

The **file verify auto** command enables image verification globally; that is, all images that are to be copied (via the **copy** command) or reloaded (via the **reload** command) are automatically verified. Although both the **copy** and **reload** commands have a **/verify** keyword that enables image verification, you must issue the keyword each time you want to copy or reload an image. The **file verify auto** command enables image verification by default, so you no longer have to specify image verification multiple times.

If you have enabled image verification by default but prefer to disable verification for a specific image copy or reload, the **/noverify** keyword, along with either the **copy** or the **reload** command, will override the **file verify auto** command.

Use this task to enable automatic image verification.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **file verify auto**
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**file verify auto** **Example:** `Router(config)# file verify auto`	Enables automatic image verification.
Step 4	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode. You must exit global configuration mode if you are going to copy or reload an image.

- What to Do Next, page 19

What to Do Next

After issuing the **file verify auto** command, you do not have to issue the **/verify** keyword with the **copy** or the **reload** command because each image that is copied or reloaded will be automatically verified.

Verifying the Integrity of an Image That Is About to Be Copied

When issuing the **copy** command, you can verify the integrity of the copied file by entering the **/verify** keyword. If the integrity check fails, the copied file will be deleted. If the file that is about to be copied does not have an embedded hash (an old image), you will be prompted whether or not to continue with the copying process. If you choose to continue, the file will be successfully copied; if you choose not to continue, the copied file will be deleted.

Without the **/verify** keyword, the **copy** command could copy a file that is not valid. Thus, after the **copy** command has been successfully executed, you can issue the **verify** command at any time to check the integrity of the files that are in the storage of the router.

Use this task to verify the integrity of an image before it is copied onto a router.

SUMMARY STEPS

1. **enable**
2. **copy** [**/erase**] [**/verify**| **/noverify**] *source-url destination-url*
3. **verify** [**/md5** [*md5-value*]] *filesystem: file-url*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**copy** [**/erase**] [**/verify**| **/noverify**] *source-url destination-url* **Example:** `Router# copy /verify tftp://10.1.1.1/ jdoe/c7200-js-mz disk0:`	Copies any file from a source to a destination. • **/verify** --Verifies the signature of the destination file. If verification fails, the file will be deleted. • **/noverify** --Does not verify the signature of the destination file before the image is copied. **Note** **/noverify** is often issued if the **file verify auto** command is enabled, which automatically verifies the signature of all images that are copied.
Step 3	**verify** [**/md5** [*md5-value*]] *filesystem: file-url*] **Example:** `Router# verify bootflash://c7200-kboot-mz.121-8a.E`	(Optional) Verifies the integrity of the images in the router's storage.

Verifying the Integrity of an Image That Is About to Be Reloaded

By issuing the **reload** command with the /**verify** keyword, the image that is about to be loaded onto your system will be checked for integrity. If the /**verify** keyword is specified, image verification will occur before the system initiates the reboot. Thus, if verification fails, the image will not be loaded.

Note Because different platforms obtain the file that is to be loaded in various ways, the file specified in BOOTVAR will be verified. If a file is not specified, the first file on each subsystem will be verified. On certain platforms, because of variables such as the configuration register, the file that is verified may not be the file that is loaded.

Use this task to verify the integrity of an image before it is reloaded onto a router.

SUMMARY STEPS

1. **enable**
2. **reload** [[**warm**] [**/verify**| **/noverify**] *text* | [**warm**] [**/verify**| **/noverify**] **in** [*hh* **:** *mm* [*text*] | [**warm**] [/**verify**| **/noverify**] **at** *hh* **:** *mm* [*month day* | *day month*] [*text*] | [**warm**] [**/verify**| **/noverify**] **cancel**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**reload** [[**warm**] [**/verify**| **/noverify**] *text* | [**warm**] [**/verify**| **/noverify**] **in** [*hh* **:** *mm* [*text*] | [**warm**] [/**verify**| **/noverify**] **at** *hh* **:** *mm* [*month day* | *day month*] [*text*] | [**warm**] [**/verify**| **/noverify**] **cancel**] **Example:** `Router# reload /verify`	Reloads the operating system. • /**verify**--Verifies the signature of the destination file. If verification fails, the file will be deleted. • **/noverify** --Does not verify the signature of the destination file before the image is reloaded. **Note** **/noverify** is often issued if the **file verify auto** command is enabled, which automatically verifies the signature of all images that are copied.

Configuration Examples for Image Verification

Global Image Verification Example

The following example shows how to enable automatic image verification. After enabling this command, image verification will automatically occur for all images that are either copied (via the **copy** command) or reloaded (via the **reload** command).

```
Router(config)# file verify auto
```

Image Verification via the copy Command Example

The following example shows how to specify image verification before copying an image:

```
Router# copy /verify tftp://10.1.1.1/jdoe/c7200-js-mz disk0:
Destination filename [c7200-js-mz]?
Accessing tftp://10.1.1.1/jdoe/c7200-js-mz...
```

```
Loading jdoe/c7200-js-mz from 10.1.1.1 (via FastEthernet0/0):!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 19879944 bytes]
19879944 bytes copied in 108.632 secs (183003 bytes/sec)
Verifying file integrity of disk0:/c7200-js-
mz  ..................................................................................
..................................................................................
..................................................................................
.........................Done!
Embedded Hash         MD5 :CFA258948C4ECE52085DCF428A426DCD
Computed Hash                MD5 :CFA258948C4ECE52085DCF428A426DCD
CCO Hash                        MD5 :44A7B9BDDD9638128C35528466318183
Signature Verified
```

Image Verification via the reload Command Example

The following example shows how to specify image verification before reloading an image onto the router:

```
Router# reload /verify
Verifying file integrity of bootflash:c7200-kboot-mz.121-8a.E
%ERROR:Signature not found in file bootflash:c7200-kboot-mz.121-8a.E.
Signature not present. Proceed with verify? [confirm]
Verifying file disk0:c7200-js-
mz ..........................................................................
............................................................Done!
Embedded Hash           MD5 :CFA258948C4ECE52085DCF428A426DCD
Computed Hash               MD5 :CFA258948C4ECE52085DCF428A426DCD
CCO Hash                MD5 :44A7B9BDDD9638128C35528466318183
Signature Verified
Proceed with reload? [confirm]n
```

Verify Command Sample Output Example

The following example shows how to specify image verification via the **verify** command:

```
Router# verify disk0:c7200-js-mz
%Filesystem does not support verify operations
Verifying file integrity of disk0:c7200-js-mz.......................................
...............................................................................Done!
Embedded Hash           MD5 :CFA258948C4ECE52085DCF428A426DCD
Computed Hash               MD5 :CFA258948C4ECE52085DCF428A426DCD
CCO Hash                MD5 :44A7B9BDDD9638128C35528466318183
```

Signature Verified

Additional References

Related Documents

Related Topic	Document Title
Configuration tasks and information for loading, maintaining, and rebooting system images	Using the Cisco IOS Integrated File System feature module in the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide* , Release 12.4T.

Related Topic	Document Title
Additional commands for loading, maintaining, and rebooting system images	*Cisco IOS Configuration Fundamentals Command Reference* , Release 12.4T

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
• None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Image Verification

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 3 Feature Information for Image Verification

Feature Name	Releases	Feature Information
Image Verification	12.2(25)S 12.0(26)S 12.3(4)T Cisco IOS XE Release 2.1	The Image Verification feature allows users to automatically verify the integrity of Cisco IOS images. The following commands were introduced or modified: **copy**, **file verify auto**, **reload**, **verify**.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

IP Source Tracker

The IP Source Tracker feature tracks information in the following ways:

- Gathers information about the traffic that is flowing to a host that is suspected of being under attack.
- Generates all the necessary information in an easy-to-use format to track the network entry point of a DoS attack.
- Tracks Multiple IPs at the same time.
- Tracks DoS attacks across the entire network.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for IP Source Tracker

Packets Can Be Dropped for Routers

IP source tracking is designed to track attacks against hosts. Packets can be dropped if the line card or port adapter CPU is overwhelmed. Therefore, when used to track an attack against a router, IP source tracking can drop control packets, such as Border Gateway Protocol (BGP) updates.

Engine 0 and 1 Performances Affected on Cisco 12000 Series

There is no performance impact for packets destined to nontracked IP addresses on Engine 2 and Engine 4 line cards because the IP source tracker affects only tracked destinations. Engine 0 and Engine 1 performances are affected because on these engines all packets are switched by the CPU.

Note On Cisco 7500 series routers, there is no performance impact on destinations that are not tracked.

Information About IP Source Tracker

- Identifying and Tracking Denial of Service Attacks, page 26
- Using IP Source Tracker, page 27

Identifying and Tracking Denial of Service Attacks

One of the many challenges faced by customers today is the tracking and blocking denial-of-service (DoS) attacks. Counteracting a DoS attack involves intrusion detection, source tracking, and blocking. This functionality addresses the need for source tracking.

To trace attacks, NetFlow and access control lists (ACLs) have been used. To block attacks, committed access rate (CAR) and ACLs have been used. Support for these features on the Cisco 12000 series Internet router has depended on the type of line card used. Support for these features on the Cisco 7500 series routers depends upon the type of port adapter used. There is, therefore, a need to develop a way to receive information that both traces the source of an attack and is supported on all line cards and port adapters.

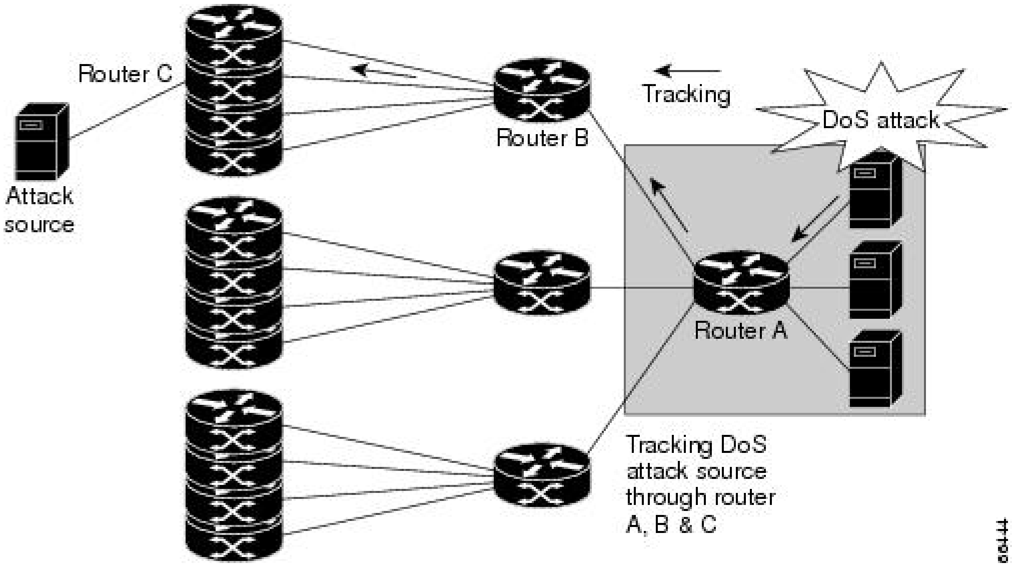
Normally, when you identify the host that is subject to a DoS attack, you must determine the network ingress point to effectively block the attack. This process starts at the router closest to the host.

For example, in the figure below, you would start at Router A and try to determine the next upstream router to examine. Traditionally, you would apply an output ACL to the interface connecting to the host to log packets that match the ACL. The logging information is dumped to the router console or system log. You then have to analyze this information, and possibly go through several ACLs in succession to identify the input interface for the attack. In this case the information points back to Router B.

You then repeat this process on Router B, which leads back to Router C, an ingress point into the network. At this point you can use ACLs or CAR to block the attack. This procedure can require applying several

ACLs that generate an excessive amount of output to analyze, making this procedure cumbersome and error prone.

Figure 1



Using IP Source Tracker

IP source tracker provides an easier, more scalable alternative to output ACLs for tracking DoS attacks, and it works as follows:

- After you identify the destination being attacked, enable tracking for the destination address on the whole router by entering the **ip source-track** command.
- Each line card creates a special Cisco Express Forwarding (CEF) entry for the destination address being tracked. For line cards or port adapters that use specialized Application-Specific Integrated Circuit (ASICs) for packet switching, the CEF entry is used to punt packets to the line card's or port adapter's CPU.
- Each line card CPU collects information about the traffic flow to the tracked destination.
- The data generated is periodically exported to the router. To display a summary of the flow information, enter the **show ip source-track summary** command. To display more detailed information for each input interface, enter the **show ip source-track** command.
- Statistics provide a breakdown of the traffic to each tracked IP address. This breakdown allows you to determine which upstream router to analyze next. You can shut down the IP source tracker on the current router by entering the **no ip source-track** command, and reopen it on the upstream router.
- Repeat Step 1 to Step 5 until you identify the source of the attack.
- Apply CAR or ACLs to limit or stop the attack.

- IP Source Tracker Hardware Support, page 27

IP Source Tracker Hardware Support

IP source tracking is supported on all Engine 0, 1, 2, and 4 line cards in the Cisco 12000 series Internet router. It is also supported on all port adapters and RSPs that have CEF switching enabled on Cisco 7500 series routers.

How to Configure IP Source Tracker

- Configuring IP Source Tracking, page 28
- Verifying IP Source Tracking, page 29

Configuring IP Source Tracking

To configure IP source tracking for a host under attack, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip source-track** *ip-address*
4. **ip source-track address-limit** *number*
5. **ip source-track syslog-interval** *number*
6. **ip source-track export-interval** *number*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip source-track** *ip-address* **Example:** `Router(config)# ip source-track 100.10.0.1`	Enables IP source tracking for a specified host.

	Command or Action	Purpose
Step 4	**ip source-track address-limit** *number* **Example:** `Router(config)# ip source-track address-limit 10`	(Optional) Limits the number of hosts that can be simultaneously tracked at any given time. **Note** If this command is not enabled, there is no limit to the number of hosts that be can tracked.
Step 5	**ip source-track syslog-interval** *number* **Example:** `Router(config)# ip source-track syslog-interval 2`	(Optional) Sets the time interval, in minutes, used to generate syslog messages that indicate IP source tracking is enabled. **Note** If this command is not enabled, system log messages are not generated.
Step 6	**ip source-track export-interval** *number* **Example:** `Router(config)# ip source-track export-interval 30`	(Optional) Sets the time interval, in seconds, used to export IP tracking statistics that are collected in the line cards to the gigabit route processor (GRP) and the port adapters to the route switch processor (RSP). **Note** If this command is not enabled, traffic flow information is exported to the GRP and RSP every 30 seconds.

- What to Do Next, page 29

What to Do Next

After you have configured source tracking on your network device, you can verify your configuration and source tracking statistics, such as traffic flow. To complete this task, see the following section "Verifying IP Source Tracking, page 29."

Verifying IP Source Tracking

To verify the status of source tracking, such as packet processing and traffic flow information, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **show ip source-track** [*ip-address*] [**summary** | **cache**
3. **show ip source-track export flows**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip source-track** [*ip-address*] [**summary** | **cache** **Example:** `Router# show ip source-track summary`	Displays traffic flow statistics for tracked IP host addresses
Step 3	**show ip source-track export flows** **Example:** `Router# show ip source-track export flows`	Displays the last 10 packet flows that were exported from the line card to the route processor. **Note** This command can be issued only on distributed platforms, such as the GRP and the RSP.

Example

The following example, which is sample output from the **show ip source-track summary** command, shows how to verify that IP source tracking is enabled for one or more hosts:

```
Router# show ip source-track summary
Address          Bytes    Pkts    Bytes/s   Pkts/s
10.0.0.1          119G   1194M    443535      4432
192.168.1.1       119G   1194M    443535      4432
192.168.42.42     119G   1194M    443535      4432
```

The following example, which is sample output from the **show ip source-track summary** command, shows how to verify that no traffic has yet to be received for the destination hosts that are being tracked:

```
Router# show ip source-track summary
Address        Bytes   Pkts   Bytes/s   Pkts/s
10.0.0.1           0      0         0        0
192.168.1.1        0      0         0        0
192.168.42.42      0      0         0        0
```

The following example, which is sample output from the **show ip source-track**command, shows how to verify that IP source tracking is processing packets to the hosts and exporting statistics from the line card or port adapter to the GRP and RSP:

```
Router# show ip source-track
Address         SrcIF    Bytes   Pkts   Bytes/s   Pkts/s
10.0.0.1        PO0/0    119G   1194M    513009     5127
192.168.1.1     PO0/0    119G   1194M    513009     5127
```

192.168.42.42 PO0/0 119G 1194M 513009 5127

Configuration Examples for IP Source Tracker

Configuring IP Source Tracking Example

The following example shows how to configure IP source tracking on all line cards and port adapters in the router. In this example, each line card or port adapter collects traffic flow data to host address 100.10.0.1 for 2 minutes before creating an internal system log entry; packet and flow information recorded in the system log is exported for viewing to the route processor or switch processor every 60 seconds.

```
Router# configure interface
Router(config)# ip source-track 100.10.0.1
Router(config)# ip source-track syslog-interval 2
Router(config)# ip source-track export-interval 60
```

Verifying Source Interface Statistics for All Tracked IP Addresses Example

The following example displays a summary of the traffic flow statistics that are collected on each source interface for tracked host addresses.

```
Router# show ip source-track
Address         SrcIF     Bytes    Pkts     Bytes/s     Pkts/s
10.0.0.1        PO2/0         0       0           0          0
192.168.9.9     PO1/2      131M    511M        1538          6
192.168.9.9     PO2/0      144G   3134M     6619923     143909
```

Verifying a Flow Statistic Summary for All Tracked IP Addresses Example

The following example displays a summary of traffic flow statistics for all hosts that are being tracked; it shows that no traffic has yet been received.

```
Router# show ip source-track summary
Address              Bytes    Pkts     Bytes/s     Pkts/s
10.0.0.1                 0       0           0          0
100.10.1.1            131M    511M        1538          6
192.168.9.9           146G   3178M     6711866     145908
```

Verifying Detailed Flow Statistics Collected by a Line Card Example

The following example displays traffic flow information that is collected on line card 0 for all tracked hosts.

```
Router# exec slot 0 show ip source-track cache
========= Line Card (Slot 0) =======
IP packet size distribution (7169M total packets):
   1-32   64   96  128  160  192  224  256  288  320  352  384  416  448  480
   .000 .000 .000 0.00 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000
    512  544  576 1024 1536 2048 2560 3072 3584 4096 4608
   .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000
```

```
IP Flow Switching Cache, 278544 bytes
  1 active, 4095 inactive, 13291 added
  198735 ager polls, 0 flow alloc failures
  Active flows timeout in 0 minutes
  Inactive flows timeout in 15 seconds
  last clearing of statistics never
Protocol         Total    Flows   Packets Bytes  Packets Active(Sec) Idle(Sec)
--------         Flows     /Sec     /Flow  /Pkt     /Sec     /Flow     /Flow
SrcIf          SrcIPaddress    DstIf          DstIPaddress    Pr TOS Flgs  Pkts
Port Msk AS                    Port Msk AS    NextHop              B/Pk  Active
PO0/0          101.1.1.0       Null           100.1.1.1       06 00  00      55K
0000 /0  0                     0000 /0  0     0.0.0.0              100    10.1
```

Verifying Flow Statistics Exported from Line Cards and Port Adapters Example

The following example displays packet flow information that is exported from line cards and port adapters to the GRP and the RSP:

```
Router# show ip source-track export flows
SrcIf         SrcIPaddress    DstIf         DstIPaddress    Pr SrcP DstP  Pkts
PO0/0         101.1.1.0       Null          100.1.1.1       06 0000 0000    88K
PO0/0         101.1.1.0       Null          100.1.1.3       06 0000 0000    88K
PO0/0         101.1.1.0       Null          100.1.1.2       06 0000 0000    88K
```

Additional References

The following sections provide references related to IP Source Tracker.

Related Documents

Related Topic	Document Title
ACLs	*Cisco IOS Security Configuration Guide: Securing the Data Plane* , Release 12.4T
Dynamic ACLs	Configuring Lock-and-Key Security (Dynamic Access Lists)
DoS prevention	Configuring TCP Intercept (Preventing Denial-of-Service Attacks)

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for IP Source Tracker

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 4 Feature Information for IP Source Tracker

Feature Name	Releases	Feature Information
IP Source Tracker	12.0(21)S 12.0(22)S 12.0(26)S 12.3(7)T 12.2(25)S	The IP Source Tracker feature allows information to be gathered about the traffic that is flowing to a host that is suspected of being under attack. This feature was introduced in Release 12.0(21)S on the Cisco 12000 series. This feature was implemented in Release 12.0(22)S on the Cisco 7500 series. This feature was implemented in Release 12.0(26)S on the Cisco 12000 series IP Service Engine (ISE) line cards. This feature was integrated into Cisco IOS Release 12.3(7)T. This feature was integrated into Cisco IOS Release 12.2(25)S. The following commands were introduced or modified: **ip source-track, ip source-track address-limit, ip source-track export-interval, ip source-track syslog-interval, show ip source-track, show ip source-track export flows.**

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

Role-Based CLI Access

First Published: February 24, 2004

Last Updated: March 30, 2011

The Role-Based CLI Access feature allows the network administrator to define “views,” which are a set of operational commands and configuration capabilities that provide selective or partial access to Cisco IOS EXEC and configuration (config) mode commands. Views restrict user access to Cisco IOS command-line interface (CLI) and configuration information; that is, a view can define what commands are accepted and what configuration information is visible. Thus, network administrators can exercise better control over access to Cisco networking devices.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Role-Based CLI Access

Your image must support CLI views.

Restrictions for Role-Based CLI Access

Lawful Intercept Images Limitation

Because CLI views are a part of the Cisco IOS parser, CLI views are a part of all platforms and Cisco IOS images. However, the lawful intercept view is available only in images that contain the lawful intercept subsystem.

Maximum Number of Allowed Views

The maximum number of CLI views and superviews, including one lawful intercept view, that can be configured is 15. (This does not include the root view.)

Information About Role-Based CLI Access

Benefits of Using CLI Views

Although users can control CLI access via both privilege levels and enable mode passwords, these functions do not provide network administrators with the necessary level of detail needed when working with Cisco IOS routers and switches. CLI views provide a more detailed access control capability for network administrators, thereby, improving the overall security and accountability of Cisco IOS software.

As of Cisco IOS Release 12.3(11)T, network administrators can also specify an interface or a group of interfaces to a view; thereby, allowing access on the basis of specified interfaces.

Root View

When a system is in “root view,” it has all of the access privileges as a user who has level 15 privileges. If the administrator wishes to configure any view to the system (such as a CLI view, a superview, or a lawful intercept view), the system must be in root view.

The difference between a user who has level 15 privileges and a root view user is that a root view user can configure a new view and add or remove commands from the view. Also, when you are in a CLI view, you have access only to the commands that have been added to that view by the root view user.

About Lawful Intercept Views

Like a CLI view, a lawful intercept view restricts access to specified commands and configuration information. Specifically, a lawful intercept view allows a user to secure access to lawful intercept commands that are held within the TAP-MIB, which is a special set of simple network management protocol (SNMP) commands that store information about calls and users.

Commands available in lawful intercept view belong to one of the these categories:

- Lawful intercept commands that should not be made available to any other view or privilege level
- CLI views that are useful for lawful intercept users but do not have to be excluded from other views or privilege levels

About Superviews

A superview consists of one or more CLI views, which allow users to define what commands are accepted and what configuration information is visible. Superviews allow a network administrator to easily assign all users within configured CLI views to a superview instead of having to assign multiple CLI views to a group of users.

Superviews contain these characteristics:

- A CLI view can be shared among multiple superviews.
- Commands cannot be configured for a superview; that is, you must add commands to the CLI view and add that CLI view to the superview.
- Users who are logged into a superview can access all of the commands that are configured for any of the CLI views that are part of the superview.
- Each superview has a password that is used to switch between superviews or from a CLI view to a superview.
- If a superview is deleted, all CLI views associated with that superview will not be deleted too.

View Authentication via a New AAA Attribute

View authentication is performed by an external authentication, authorization, and accounting (AAA) server via the new attribute "cli-view-name."

AAA authentication associates only one view name to a particular user; that is, only one view name can be configured for a user in an authentication server.

How to Use Role-Based CLI Access

Configuring a CLI View

Perform this task to create a CLI view and add commands or interfaces to the view, as appropriate.

Before you create a view, you must perform the following tasks:

- Enable AAA via the **aaa new-model**command .
- Ensure that your system is in root view--not privilege level 15.

SUMMARY STEPS

1. **enable view**
2. **configure terminal**
3. **parser view** *view-name*
4. **secret 5** *encrypted-password*
5. **commands** *parser-mode* {**include** | **include-exclusive** | **exclude**} [**all**] [**interface** *interface-name* | *command*]
6. **exit**
7. **exit**
8. **enable** [*privilege-level*] [**view** *view-name*
9. **show parser view all**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable view** **Example:** `Router> enable view`	Enables root view. • Enter your privilege level 15 password (for example, root password) if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**parser view** *view-name* **Example:** `Router(config)# parser view first`	Creates a view and enters view configuration mode.
Step 4	**secret 5** *encrypted-password* **Example:** `Router(config-view)# secret 5 secret`	Associates a command-line interface (CLI) view or superview with a password. **Note** You must issue this command before you can configure additional attributes for the view.

	Command or Action	Purpose
Step 5	**commands** *parser-mode* {**include** | **include-exclusive** | **exclude**} [**all**] [**interface** *interface-name* | *command*] **Example:** `Router(config-view)# commands exec include show version`	Adds commands or interfaces to a view. • *parser-mode* --The mode in which the specified command exists. • **include** --Adds a command or an interface to the view and allows the same command or interface to be added to an additional view. • **include-exclusive** --Adds a command or an interface to the view and excludes the same command or interface from being added to all other views. • **exclude** --Excludes a command or an interface from the view; that is, customers cannot access a command or an interface. • **all** --A "wildcard" that allows every command in a specified configuration mode that begins with the same keyword or every subinterface for a specified interface to be part of the view. • **interface** *interface-name* -- Interface that is added to the view. • *command* --Command that is added to the view.
Step 6	**exit** **Example:** `Router(config-view)# exit`	Exits view configuration mode.
Step 7	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode.
Step 8	**enable** [*privilege-level*] [**view** *view-name* **Example:** `Router# enable view first`	Prompts the user for a password, which allows the user to access a configured CLI view, and is used to switch from one view to another view. After the correct password is given, the user can access the view.
Step 9	**show parser view all** **Example:** `Router# show parser view`	(Optional) Displays information about the view that the user is currently in. • **all** --Displays information for all views that are configured on the router. **Note** Although this command is available for both root and lawful intercept users, the **all** keyword is available only to root users. However, the **all** keyword can be configured by a user in root view to be available for users in lawful intercept view and CLI view.

- Troubleshooting Tips, page 39

Troubleshooting Tips

After you have successfully created a view, a system message such as the following is displayed:

```
%PARSER-6-VIEW_CREATED: view ‘first’ successfully created.
```

After you have successfully deleted a view, a system message such as the following is displayed:

%PARSER-6-VIEW_DELETED: view ‘first’ successfully deleted.

You must associate a password with a view. If you do not associate a password, and you attempt to add commands to the view via the **commands** command, a system message such as the following will be displayed:

```
%Password not set for view <viewname>.
```

Configuring a Lawful Intercept View

Perform this task to initialize and configure a view for lawful-intercept-specific commands and configuration information.

Before you initialize a lawful intercept view, ensure that the privilege level is set to 15 via the **privilege** command.

Note Only an administrator or a user who has level 15 privileges can initialize a lawful intercept view.

>

SUMMARY STEPS

1. **enable view**
2. **configure terminal**
3. **li-view** *li-password* **user** *username* **password** *password*
4. **username lawful-intercept** [*name*] [**privilege** *privilege-level* | **view** *view-name*] **password** *password*
5. **parser view** *view-name*
6. **secret 5** *encrypted-password*
7. **name** *new-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable view** **Example:** `Router> enable view`	Enables root view. • Enter your privilege level 15 password (for example, root password) if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**li-view** *li-password* **user** *username* **password** *password* **Example:** `Router(config)# li-view lipass user li_admin password li_adminpass`	Initializes a lawful intercept view. After the li-view is initialized, you must specify at least one user via **user** *username* **password** *password* options.
Step 4	**username lawful-intercept** [*name*] [**privilege** *privilege-level* | **view** *view-name*] **password** *password* **Example:** `Router(config)# username lawful-intercept li-user1 password li-user1pass`	Configures lawful intercept users on a Cisco device.
Step 5	**parser view** *view-name* **Example:** `Router(config)# parser view li view name`	(Optional) Enters view configuration mode, which allows you to change the lawful intercept view password or the lawful intercept view name.
Step 6	**secret 5** *encrypted-password* **Example:** `Router(config-view)# secret 5 secret`	(Optional) Changes an existing password for a lawful intercept view.
Step 7	**name** *new-name* **Example:** `Router(config-view)# name second`	(Optional) Changes the name of a lawful intercept view. If this command is not issued, the default name of the lawful intercept view is “li-view.”

- Troubleshooting Tips, page 41

Troubleshooting Tips

To display information for all users who have access to a lawful intercept view, issue the **show users lawful-intercept** command. (This command is available only to authorized lawful intercept view users.)

Configuring a Superview

Perform this task to create a superview and add at least one CLI view to the superview.

Before adding a CLI view to a superview, ensure that the CLI views that are added to the superview are valid views in the system; that is, the views have been successfully created via the **parser view** command.

Note You can add a view to a superview only after a password has been configured for the superview (via the **secret 5** command). Thereafter, issue the **view** command in view configuration mode to add at least one CLI view to the superview.

>

SUMMARY STEPS

1. **enable view**
2. **configure terminal**
3. **parser view** *superview-name* **superview**
4. **secret 5** *encrypted-password*
5. **view** *view-name*
6. **exit**
7. **exit**
8. **show parser view all**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable view** **Example:** `Router> enable view`	Enables root view. • Enter your privilege level 15 password (for example, root password) if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**parser view** *superview-name* **superview** **Example:** `Router(config)# parser view su_view1 superview`	Creates a superview and enters view configuration mode.

	Command or Action	Purpose
Step 4	**secret 5** *encrypted-password* **Example:** `Router(config-view)# secret 5 secret`	Associates a CLI view or superview with a password. **Note** You must issue this command before you can configure additional attributes for the view.
Step 5	**view** *view-name* **Example:** `Router(config-view)# view view_three`	Adds a normal CLI view to a superview. Issue this command for each CLI view that is to be added to a given superview.
Step 6	**exit** **Example:** `Router(config-view)# exit`	Exits view configuration mode.
Step 7	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode.
Step 8	**show parser view all** **Example:** `Router# show parser view`	(Optional) Displays information about the view that the user is currently in. • **all** --Displays information for all views that are configured on the router. **Note** Although this command is available for both root and lawful intercept users, the **all** keyword is available only to root users. However, the **all** keyword can be configured by a user in root view to be available for users in lawful intercept view and CLI view.

Monitoring Views and View Users

To display debug messages for all views--root, CLI, lawful intercept, and super--use the **debug parser view** command in privileged EXEC mode.

Configuration Examples for Role-Based CLI Access

- Example Configuring a CLI View, page 44
- Example Verifying a CLI View, page 44

- Example Configuring a Lawful Intercept View, page 45
- Example Configuring a Superview, page 46

Example Configuring a CLI View

The following example shows how to configure two CLI views, “first” and “second.” Thereafter, you can verify the CLI view in the running configuration.

```
Router(config)# parser view first
00:11:40:%PARSER-6-VIEW_CREATED:view 'first' successfully created.
Router(config-view)# secret 5 firstpass
Router(config-view)# command exec include show version
Router(config-view)# command exec include configure terminal
Router(config-view)# command exec include all show ip
Router(config-view)# exit
Router(config)# parser view second
00:13:42:%PARSER-6-VIEW_CREATED:view 'second' successfully created.
Router(config-view)# secret 5 secondpass
Router(config-view)# command exec include-exclusive show ip interface
Router(config-view)# command exec include logout
Router(config-view)# exit
!
!
Router(config-view)# do show run | beg view
parser view first
 secret 5 $1$MCmh$QuZaU8PIMPlff9sFCZvgW/
 commands exec include configure terminal
 commands exec include configure
 commands exec include all show ip
 commands exec include show version
 commands exec include show
!
parser view second
 secret 5 $1$iP2M$R16BXKecMEiQesxLyqygW.
 commands exec include-exclusive show ip interface
 commands exec include show ip
 commands exec include show
 commands exec include logout
!
```

Example Verifying a CLI View

After you have configured the CLI views “first” and “second,” you can issue the **enable view**command to verify which commands are available in each view. The following example shows which commands are available inside the CLI view “first” after the user has logged into this view. (Because the **show ip** command is configured with the all option, a complete set of suboptions is shown, except the **show ip interface** command, which is using the include-exclusive keyword in the second view.)

```
Router# enable view first
Password:
00:28:23:%PARSER-6-VIEW_SWITCH:successfully set to view 'first'.
Router# ?
Exec commands:
  configure  Enter configuration mode
  enable     Turn on privileged commands
  exit       Exit from the EXEC
  show       Show running system information
Router# show ?
  ip       IP information
  parser   Display parser information
  version  System hardware and software status
Router# show ip ?

  access-lists            List IP access lists
  accounting              The active IP accounting database
  aliases                 IP alias table
  arp                     IP ARP table
  as-path-access-list     List AS path access lists
  bgp                     BGP information
  cache                   IP fast-switching route cache
  casa                    display casa information
  cef                     Cisco Express Forwarding
  community-list          List community-list
  dfp                     DFP information
  dhcp                    Show items in the DHCP database
  drp                     Director response protocol
  dvmrp                   DVMRP information
  eigrp                   IP-EIGRP show commands
  extcommunity-list       List extended-community list
  flow                    NetFlow switching
  helper-address          helper-address table
  http                    HTTP information
  igmp                    IGMP information
  irdp                    ICMP Router Discovery Protocol
.
.
.
```

Example Configuring a Lawful Intercept View

The following example shows how to configure a lawful intercept view, add users to the view, and verify the users that were added:

```
!Initialize the LI-View.
Router(config)# li-view lipass user li_admin password li_adminpass
00:19:25:%PARSER-6-LI_VIEW_INIT:LI-View initialized.
Router(config)# end
! Enter the LI-View; that is, check to see what commands are available within the view.
Router# enable view li-view
Password:
Router#
00:22:57:%PARSER-6-VIEW_SWITCH:successfully set to view 'li-view'.
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# parser view li-view

Router(config-view)# ?
View commands:
  commands  Configure commands for a view
  default   Set a command to its defaults
  exit      Exit from view configuration mode
  name      New LI-View name      ===This option only resides in LI View.
  no        Negate a command or set its defaults
  password  Set a password associated with CLI views
Router(config-view)#
! NOTE:LI View configurations are never shown as part of ‘running-configuration’.
! Configure LI Users.
Router(config)# username lawful-intercept li-user1 password li-user1pass

Router(config)# username lawful-intercept li-user2 password li-user2pass
! Displaying LI User information.
Router# show users lawful-intercept
li_admin
li-user1
li-user2
Router#
```

Example Configuring a Superview

The following sample output from the **show running-config** command shows that “view_one” and “view_two” have been added to superview “su_view1,” and “view_three” and “view_four” have been added to superview “su_view2”:

```
!
parser view su_view1 superview
 secret 5 <encoded password>
 view view_one
 view view_two
!
parser view su_view2 superview
 secret 5 <encoded password>
 view view_three
 view view_four
!
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Security commands	*Cisco IOS Security Command Reference*
SNMP, MIBs, CLI configuration	*Cisco IOS Network Management Configuration Guide* , Release 15.0.
Privilege levels	Configuring Security with Passwords, Privilege Levels and, Login Usernames for CLI Sessions on Networking Devices” module.

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Role-Based CLI Access

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 5 Feature Information for Role-Based CLI Access

Feature Name	Releases	Feature Information
Role-Based CLI Access	12.3(7)T 12.3(11)T 12.2(33)SRB 12.2(33)SB 12.2(33)SXI Cisco IOS XE 3.1.0SG	This feature enables network administrators to restrict user access to CLI and configuration information. In 12.3(11)T, the CLI view capability was extended to restrict user access on a per-interface level, and additional CLI views were introduced to support the extended view capability. Also, support to group configured CLI views into a superview was introduced. The following commands were introduced or modified: **commands (view) , enable , li-view , name (view) , parser view , parser view superview, secret , show parser view , show users , username , view**.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.